Claims:

1. A magnetic nanoparticle having a core of metal atoms, wherein the core is covalently linked to a plurality of ligands and has a diameter of less than 2.5nm.

2. The magnetic nanoparticle of claim 1, wherein the core comprises passive metal atoms and magnetic metal atoms.

3. The magnetic nanoparticle of claim 1, wherein the core comprises passive metal atoms.

4. The magnetic nanoparticle of claim 2 or claim 3, wherein the passive metal is gold, platinum, silver or copper and the optional magnetic metal is iron, cobalt or gadolinium.

5. The magnetic nanoparticle of any one of the preceding claims, wherein the core is formed from atoms of Au, Au/Fe, Au/Cu, Au/Gd, Au/Fe/Cu, Au/Fe/Gd or Au/Fe/Cu/Gd.

6. The magnetic nanoparticle of any one of claims 2 to 5, wherein the ratio of passive metal atoms to magnetic metal atoms in the core is between about 5:0 and about 2:5

7. The magnetic nanoparticle of any one of claims 2, 4 or 5, wherein the ratio of passive metal atoms to magnetic metal atoms in the core is between about 5:0.1 and about 5:1.

8. The magnetic nanoparticle of any one of claims 2, 4, 5 or 7, wherein the passive metal is gold and the magnetic metal is iron.

9. The magnetic nanoparticle of claim 8, wherein the ratio of gold atoms to iron atoms is about 5:0.1.

10. The magnetic nanoparticle of claim 8, wherein the ratio of gold atoms to iron atoms is about 5:1.

11. The magnetic nanoparticle of any one of claims 1, 2 4 or 5, wherein the core has a diameter of less than 2.0 nm when the core contains only passive metal atoms such as Au.

12. The magnetic nanoparticle of any one of the preceding claims, wherein the ligand incorporates a lanthanide.

13. The magnetic nanoparticle of claim 12, wherein the lanthanide is gadolinium.

14. The magnetic nanoparticle of any one of the preceding claims, wherein the nanoparticle comprises an NMR active atom.

15. The magnetic nanoparticle of claim 14, wherein the NMR active atom is Mn^{+2}, Gd^{+3}, Eu^{+2}, Cu^{+2}, V^{+2}, Co^{+2}, Ni^{+2}, Fe^{+2}, Fe^{+3} or a $lanthanide^{+3}$.

16. The nanoparticle of any one of the preceding claims, wherein the ligand comprises a carbohydrate group.

17. The nanoparticle of any one of the preceding claims, wherein the ligand comprises a polysaccharide, an oligosaccharide or a monosaccharide group.

18. The nanoparticle of any one of the preceding claims, wherein the ligand comprises a glycanoconjugate.

19. The nanoparticle of claim 18, wherein the glycanoconjugate is a glycolipid or a glycoprotein.

20. The nanoparticle of any one of the preceding claims, wherein the ligand is linked to the core via a sulphide group.

21. The nanoparticle of any one of the preceding claims, wherein the nanoparticle comprises a label.

22. The nanoparticle of claim 21, wherein the label is a fluorescent group or a radioactive isotope or a NMR active atom.

23. The nanoparticle of any one of the preceding claims, wherein the nanoparticle comprises a peptide.

24. The nanoparticle of any one of the preceding claims, wherein the nanoparticle comprises DNA or RNA.

25. The nanoparticle of any one of the preceding claims, wherein the nanoparticle comprises a pharmaceutically active component.

26. The nanoparticle of any one of the preceding claims, wherein the ligand is capable of binding a receptor on a cell.

27. The nanoparticle of any one of the preceding claims, wherein the nanoparticle is water soluble.

28. A composition comprising a population of one or more of the nanoparticles of any one of claims 1 to 27.

29. The composition of claim 28 which comprises a plurality of nanoparticles having different ligand groups.

30. A composition comprising a population of one or more of the nanoparticles of any one of claims 1 to 27 for use in a method of medical treatment.

31. The composition of any one of claims 28 to 30, which composition is a colloid.

32. The colloid of claim 31, wherein the nanoparticles have a mean diameter of less than 2nm.

33. The colloid of claim 31 or claim 32, which colloid is stable for at least about 1 year.

34. Use of a nanoparticle of any one of claims 1 to 27 or a composition of any one of claims 28 to 33 for the preparation of a medicament for the treatment of a condition ameliorated by the administration of the ligand.

35. The use of claim 34, wherein the ligand inhibits a carbohydrate mediated interaction that would otherwise cause a pathology.

36. The use of claim 34 or claim 35, wherein the nanoparticle has a plurality of ligands attached thereto so that it is capable of inhibiting polyvalent carbohydrate mediated interactions.

37. Use of a nanoparticle of any one of claims 1 to 27 or a composition of any one of claims 28 to 33 for the preparation of a medicament for vaccinating a patient with an antigen, wherein the ligand linked to the core of the nanoparticle comprises the antigen.

38. Use of a nanoparticle of any one of claims 1 to 27 or a composition of any one of claims 28 to 33 for the preparation of a medicament for vaccinating a patient with nucleic acid encoding an antigen, wherein the ligand linked to the core of the nanoparticle comprises the nucleic acid.

39. The use according to claim 37 or 38, wherein the vaccine is administered by application of a magnetic field.

40. The use of a nanoparticle of any one of claims 1 to 27 or a composition of any one of claims 28 to 33 for the preparation of a contrast agent for magnetic resonance imaging.

41. The use of claim 40, wherein the reagent is for use in imaging the lungs of a patient.

42. The use of claim 41, wherein the imaging reagent is for use in the diagnosis or treatment of asthma and emphysema.

43. The use of any one of claims 40 to 42, wherein the nanoparticles comprise gadolinium and have a core diameter of less than 1.0nm.

44. Use of a nanoparticle of any one of claims 1 to 27 or a composition of any one of claims 28 to 33 for the preparation of a medicament for the treatment of cancer.

45. The use of claim 44, wherein the cancer is a tumour.

46. The use of claim 44 or claim 45, wherein the tumour is exposed to a high frequency magnetic field or the tumour is exposed to infrared light.

47. The use of any one of claims 44 to 46, wherein, wherein nanopartcile comprises a ligand which is a tumour associated antigen or tumour autocrine factor.

48. The use of claims 47, wherein the ligand is a carbohydrate.

49. The use of any one of claims 44 to 48, wherein the treatment of cancer is the inhibition of metastatis.

50. The use of claim 49, wherein the ligands comprise a carbohydrate with specificity or affinity for metastatis, a hormone, or DHEA, a peptide capable of binding to a cell-specific receptor, a lipid for binding a toll receptor, methylene blue for binding to metastatising melanoma cells.

51. The use of a nanoparticle of any one of claims 1 to 27 or a composition of any one of claims 28 to 33 for the preparation of a medicament for myocardial salvage.

52. A method of preparing nanoparticles according to any one of claims 1 to 26, wherein the nanoparticles comprise a core comprising gold atoms and optionally iron atoms, which core is covalently linked to a plurality of ligands, the method comprising:

(a) synthesizing a sulphide derivative of the ligand; and

(b) reacting the sulphide derivatised ligand with $HAuCl_4$ (tetrachloroauric acid), and optionally with a ferric salt where iron atoms are present in the core, in the presence of reducing agent to produce the particles.

53. The method of claim 52, wherein step (b) comprises derivatising the ligand with a linker.

54. The method of claim 53, wherein the the linker is a disulphide linker.

55. The method of claim 54, wherein the disulphide linker group is represented by the general formula $HO-(CH_2)_n-S-S-(CH_2)_m-OH$, wherein n and m are independently integers between 1 and 5.

56. The method of claim 55, wherein the ligand is derivatised as a protected disulphide.

57. The method of any one of claims 52 to 56, wherein the ligand comprises a carbohydrate group.

58. A nanoparticle as obtainable by the method of any of claims 52 to 57.

59. A method of disrupting an interaction between a carbohydrate and a binding partner, the method comprising contacting the carbohydrate and the binding partner with nanoparticles according to any one of claims 1 to 27, wherein the ligands bound to the nanoparticles comprise a carbohydrate group capable of disrupting the interaction of the carbohydrate and the binding partner.

60. A method of screening for substances capable of binding to a ligand, the method comprising (a) contacting the nanoparticles of any one of claims 1 to 27 with one or more candidate compounds and (b) determining whether the candidate compounds binds to the ligand.

61. A method of determining the presence in a sample of a substance capable of binding to a ligand, the method comprising (a) contacting the sample with the nanoparticles of any one of claims 1 to 27 so that the substance binds to the ligand of the nanoparticles and (b) determining whether binding takes place.

62. The method of claim 61, further comprising the step of correlating the presence or absence of binding with the diagnosis of a disease state associated with the presence of the substance.

63. The method of claim 61 or claim 62, wherein the substance is an antibody which is capable of binding to the ligand.

64. A method of determining whether a carbohydrate mediated interaction occurs, the method comprising (a) contacting one or more species suspected to interact via a carbohydrate mediated interaction with the

nanoparticles of any one of claims 1 to 27 and (b) determining whether the nanoparticles modulate the carbohydrate mediated interaction.

65. The method of any one of claims 59 to 64, wherein the nanoparticles are detected by nuclear magnetic resonance (NMR), aggregation, transmission electron microscopy (TEM), atomic force microscopy (AFM), surface plasmon resonance (SPR), or with nanoparticles comprising silver atoms, signal amplification using the nanoparticle-promoted reduction of silver (I).